RIVERS AND FLOODS

[River and Flood Division, MONTROSE W. HAYES, in charge]

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The floods in the upper Mississippi Basin and on the Atlantic Seaboard, in which snow and ice played a part, and the later floods caused by the eastern storm of March 16–19, will be discussed in a separate article which will appear or be referred to in a future issue of the REVIEW.

The severe cold spell that began January 22, in the North-Central States, caused a rapid freezing of the rivers; and by the end of February, ice was probably heavier in most of the States east of the Rocky Mountains and north of latitude 36° than at any time since February 1918.

The Missouri River in the vicinity of Kansas City, Mo., was frozen from bank to bank from January 31 to February 24, 1936, inclusive. This is the first time since the winter of 1911–12 the river at Kansas City has been frozen across.

Ohio River navigation in the vicinity of Cincinnati was stopped by ice on January 26, and remained suspended until February 14, when it was partly resumed; it was fully resumed on February 24. From Virginia northward, most of the rivers were frozen, except for swiftly running water, and the ice was unusually heavy. Also, a large part of Chesapeake Bay above the mouth of the Rappahannock River was frozen.

In addition to the thick ice in the rivers, the watersheds of most of the streams were covered with heavy snow; and there was considerable fear that floods would follow the breaking of ice and melting of snow. During the month the ice broke and moved out of the rivers in Virginia, Maryland, and Pennsylvania, and out of the Ohio River and most of its tributaries, the Mississippi River below Keokuk, Iowa, and the Missouri River below St. Joseph, Mo. Gorged ice caused rather severe local flooding in the James River in the vicinity of Richmond, Va., in the rivers of Pennsylvania, including the extreme upper Ohio River and its tributaries, and in the Ohio River near Evansville, Ind. The estimated total damage from flooding due to ice movement was slightly less than $700,000. The greatest damage occurred in the extreme upper Ohio, and its tributaries above Pittsburgh, Pa., in the Ohio and its tributaries near Evansville, Ind., and in the interior rivers of Ohio and Indiana.

At the close of the month the ice was intact in the upper Missouri and the upper Mississippi Rivers, and in the rivers of New York and New England.

Freshets occurred during February in most of the rivers in the Southeastern States, including Tennessee, and in the Sacramento River system in California. The rivers in Georgia, Alabama, and Mississippi were in high flood, and caused damage in excess of $500,000. In the remainder of the Southeastern States, including Tennessee, the estimated damages were considerably less and did not exceed $40,000.

Heavy rainfall over the watersheds of the Sacramento River system in California, together with melting snow in the vicinity of the 5,000-foot level, caused severe floods in the Sacramento River and several of its tributaries. The total estimated damage was in excess of $800,000.

In practically all districts, flood warnings were timely and were the means of large savings, estimated to be in excess of $2,000,000.

The following remarks have been extracted from the reports prepared at the district centers in those regions in which freshets occurred:

Raleigh, N. C.—Damage was not heavy, owing to previous floods and continued high water on the Coastal Plain.

Charleston, S. C.—No damage was reported, except an estimate of loss in prospective crops of $800.

Columbia, S. C.—No damage reported; but logging operations on the Santee River were suspended most of the month, as the Santee stages were near or somewhat above flood in the latter part of January and almost all of February. In the other rivers of the district, stages were only slightly above flood levels for short periods and no damages were reported.

Augusta, Ga.—The Savannah River was in moderate flood below Augusta through the greater part of the month, and the Ogeechee River was slightly above flood stage for short periods. Total estimated damage was $2,000.

Macon, Ga.—Excessive rains in the first week of February caused the third flood crest in the Altamaha system since January 1. The Altamaha River was above flood stage during the entire month. Total estimated flood damage in the district was $18,500.

Atlanta, Ga.—The Chattahoochee, Flint, and Apalachicola Rivers were in moderate flood during the early part of month. Estimated flood damage $16,700.

Montgomery, Ala.—Heavy rains over the watersheds in the Montgomery River district on the afternoon and night of February 3 melted snow over the upper reaches, and the combined run-off caused the highest stages recorded since the flood of 1929. The heaviest damage was borne by the highway department and the railroads. Roads and rights-of-way, fills, bridges, etc., were badly washed and seriously damaged in many places, on the small as well as on the larger streams. The total estimated damage, including suspension of business ($23,275), amounted to $382,050, and the money value of property saved by flood warnings was about $98,800.

Pensacola, Fla.—Flood stage was reached at Caryville, Fla., on the Choctawhatchee River, on February 8 and 17. Damage was negligible.

Mobile, Ala.—Excessive rainfall over the watersheds of the Black Warrior and Tombigbee Rivers on the afternoon and night of February 3 caused a moderately high flood in those rivers. Total estimated damage was $18,810.

Meridian, Miss.—The month of February opened with moderate to strong flow in the rivers, and with swamps and small streams full or nearly full; and heavy to very heavy rains occurred from February 2 to 4 over the whole district. The heavy rainfall over the upper Chickasawhay and upper Leaf watersheds caused severe floods in both of these rivers, and in the Pascagoula River, formed by their confluence. The flood at Enterprise, Miss., was the most severe since December 10, 1919. At Shubuta, Miss., it equaled, or exceeded, the flood of March 1929, by possibly a few hundredths of a foot. At Hattiesburg, Miss., the crest was about 0.9 foot less than the crest of March 1935. The rainfall was not so heavy over the Pearl River watershed, and only moderate flooding occurred in that river. The total estimated damage for the entire district, comprising the Pascagoula and Pearl River systems, was

$229,000, including an estimated damage of $50,000 in and around Meridian, Miss., which was flooded to a considerable extent by overflows from Sowashee, Chunky and Okatibee Creeks.

Asheville, N. C.—Overflows occurred only at the lowest places in banks near and above Asheville. There was no damage.

Knoxville, Tenn.—There were moderate floods in the Little and Pigeon Rivers and the French Broad in Tennessee, with total damages estimated at $10,000.

Chattanooga, Tenn.—There were moderate floods in the Little Tennessee, Hiwassee, and Tennessee Rivers. Newspapers report the failure of an earthen dam near Murphy, N. C., on a small tributary of the Hiwassee River, and the drowning of two persons. Highway traffic was inconvenienced to some extent. Estimated damage not reported.

Sacramento, Calif.—Due to heavy rains over the watersheds of the Sacramento River system, and the melting of snow in the vicinity of the 5,000-foot elevation, the river reached the highest level since March 1928, with flood stages exceeded at Red Bluff and Knights Landing. The Cosumnes and lower Mokelumne Rivers were at or above flood stage for about a week; the highest stage at Bensons Ferry, on the Mokelumne, was 2 feet above flood and the highest since March 1911. The San Joaquin also was high, but did not reach flood stage.

Heavy rains in a few of the foothills caused moderate damage to highways and railroads by wash-outs. Overflowing creeks and other minor waterways covered lowlands in numerous parts of the valleys, and interfered with highway traffic. This was notably true in the Stockton district. Several minor breaks in the levees of the Stanislaus and the San Joaquin Rivers resulted in the flooding of about 3,000 acres near the confluence of these streams. Also, water flowing through old breaks in the levee north of Colusa inundated areas, in addition to those flooded in January, on the east side of the river in the Colusa-Moulton Weir section. In most of these water-covered lands, which are largely pasture, orchard, and grain areas, no great damage will result, especially if the water drains off without great delay.

The heaviest damage was sustained on Liberty and Prospect Islands in the lower Yolo Bypass, and on a few scattered island tracts in the San Joaquin-Mokelumne delta region, all of which were flooded by the combined effect of freshet water and tides. These islands, about nine in number, were mostly planted to asparagus and other valuable crops. Approximately 6,000 acres of asparagus were under water.

At 5 p. m. of the 22d, when additional rains were in prospect, 42 flood-control gates of the Sacramento Weir, 3 miles above Sacramento, were opened. The river at Sacramento, under the influence of the American, had been rising, but was stationary at 28.7 feet for 2½ hours prior to the opening of the gates. When the gates were opened the river at Sacramento began to fall rapidly and at midnight the gage read 25.8 feet. Meanwhile the Feather River was unusually high and was discharging heavily. The 6 remaining gates of the weir were opened on the morning of the 23d. All the weir gates were closed on the 29th.

Creeks in the foothills of Amador and El Dorado Counties became torrents as the result of excessively heavy local rains. Considerable damage was done; and two men, while attempting to cross Rancheria Creek near Amador City, lost their lives when their automobile was swept from a small bridge over the stream; the bridge was washed out later. It was also reported that a man in Colusa County perished while attempting to cross Stony Creek with a team of horses.

The total estimated damage from these floods in the Sacramento and San Joaquin River systems exceeded $800,000.

Table of flood stages during February 1936

[All dates in February unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ST. LAWRENCE DRAINAGE					
Lake Erie					
	Feet			*Feet*	
St. Marys: Decatur, Ind	15	25	Mar. 1	19.5	27
St. Joseph: Fort Wayne, Ind	12	26	Mar. 2	16.3	27
Maumee:					
Fort Wayne, Ind	15	26	Mar. 2	21.0	27
Napoleon, Ohio	10	26	Mar. 2	19.4	28
Sandusky: Upper Sandusky, Ohio	13	27	28	13.8	27
ATLANTIC SLOPE DRAINAGE					
Potomac: Sycamore Island, Md	10	28	29	12.3	28
James:					
Columbia, Va	10	15	22	22.95	16
		28	(1)	11.7	29
Richmond, Va	8	Jan. 30	12	16.9	8
		14	18	15.5	15
Dan:					
Danville, Va	11	15	15	12.2	15
Clarksville, Va	13	16	17	14.8	17
Roanoke:					
Randolph, Va	18	15	17	26.8	16
Weldon, N. C	31	15	20	43.0	18
Williamston, N. C	10	7	Mar. 3	13.9	22
Fishing Creek: Enfield, N. C	14	15	18	15.0	17
Tar:					
Rocky Mount, N. C	8	6	7	8.3	7
		14	19	10.6	18
Tarboro, N. C	18	16	23	23.8	20
Greenville, N. C	13	9	25	17.7	21
Neuse:					
Neuse, N. C	14	6	7	14.8	7
		14	20	19.1	17
Smithfield, N. C	13	5	9	15.8	6
		14	22	19.9	17
Haw: Moncure, N. C	20	14	16	23.6	15
Cape Fear:					
Fayetteville, N. C	35	6	6	36.0	6
		15	18	45.7	16
Lock No. 2, Elizabethtown, N. C	20	5	10	27.8	7
		15	22	31.7	18
Lynches: Effingham, S. C	14	11	11	14.0	11
Peedee:					
Cheraw, S. C	30	5	6	32.4	6
		15	17	37.4	15
Mars Bluff Bridge, S. C	17	7	26	20.4	10
				22.0	20
Poston, S. C	18	9	29	20.2	12, 13
				21.9	22
Saluda:					
Pelzer, S. C	6	4	9	9.1	5
		15	15	6.0	15
Chappells, S. C	13	4	8	19.3	5
		14	15	13.9	14
Broad: Blairs, S. C	14	4	6	17.9	5
		15	15	16.2	15
Catawba: Catawba, S. C	11	5	5	11.0	5
		15	15	11.4	15
Wateree: Camden, S. C	23	5	6	25.4	5
		15	16	24.4	15
Santee:					
Rimini, S. C	12	1	2	13.0	1
		5	(1)	17.1	10
Ferguson, S. C	12	1	(1)	14.0	10–12, 21
Broad: Carlton, Ga	15	5	5	16.9	5
Savannah:					
Ellenton, S. C	14	5	27	25.6	7
Clyo, Ga	13	1	4	15.4	1
		10	29	19.3	12
Ogeechee:					
Midville, Ga	6	8	10	6.9	9
Dover, Ga	7	1	2	7.3	1
		7	27	9.3	12
Ocmulgee:					
Macon, Ga	18	4	7	20.6	6
Hawkinsville, Ga	25	9	10	26.1	9
Abbeville, Ga	11	7	23	15.9	11
Lumber City, Ga	15	14	19	17.4	15
Oconee:					
Milledgeville, Ga	22	4	9	26.1	5
Dublin, Ga	22	8	12	24.0	9
Altamaha:					
Charlotte, Ga	12	1	29	21.4	15
Everett City, Ga	10	1	29	13.2	21

1 Continued into March.

Table of flood stages during February 1936—Continued

[All dates in February unless otherwise specified]

River and staton	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
EAST GULF OF MEXICO DRAINAGE					
Chattahoochee:	*Feet*			*Feet*	
Norcross, Ga	16	5	6	19.4	6
West Point, Ga	19	5	6	20.8	5
Columbus, Ga	34	5	6	35.0	5
Eufaula, Ala	40	5	9	44.7	7
Columbia, Ala	42	7	8	43.0	8
Alaga, Ala	32	6	11	38.2	8
Flint:					
Albany, Ga	20	8	14	23.4	10
		17	17	20.3	17
Bainbridge, Ga	25	12	14	25.2	13
Apalachicola:					
River Junction, Fla	20	8	13	22.8	10
		16	17	20.1	16
Blountstown, Fla	15	1	29	22.4	11
Choctawhatchee: Caryville, Fla	12	9	10	12.0	9, 10
		17	19	12.4	17
Oostanaula:					
Resaca, Ga	22	4	8	30.8	6
Rome, Ga	25	4	10	33.3	6
Etowah: Canton, Ga	17	4	5	23.2	5
Coosa:					
Mayos Bar Lock, Ga	28	5	10	36.7	6
Gadsden, Ala	20	5	15	28.4	10
Lock No. 4, Lincoln, Ala	17	4	15	24.0	5
Wetumpka, Ala	45	4	10	52.3	7
Tallapoosa: Milstead, Ala	40	5	6	45.2	5
Alabama:					
Montgomery, Ala	30	5	11	52.9	7
Selma, Ala	35	5	19	53.3	10
Millers Ferry, Ala	40	5	21	53.0	12, 13
Black Warrior: Lock No. 10, Tuscaloosa, Ala	46	4	9	63.5	4
Tombigbee:					
Lock No. 4, Demopolis, Ala	39	4	22	61.8	11
Lock No. 3	33	4	25	59.7	13
Lock No. 2	46	4	23	61.3	14
Lock No. 1	31	4	27	41.7	17
Leaf: Hattiesburg, Miss	18	6	9	21.9	7
Chickasawhay:					
Enterprise, Miss	20	4	7	35.7	5
Shubuta, Miss	26	4	11	40.45	7
Pascagoula: Merrill, Miss	22	8	15	25.4	11
Bogue Chitto: Franklinton, La	10	6	7	16.0	6
Pearl:					
Edinburg, Miss	20	4	11	25.4	7
Jackson, Miss	18	4	22	32.5	12
Monticello, Miss	15	4	23	22.6	4
Columbia, Miss	17	5	24	22.1	8
Pearl River, La	12	7	(1)	15.8	10
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Skunk: Augusta, Iowa	15	26	26	15.8	26
Des Moines: Des Moines, Iowa	9	27	27	9.5	27
Fox: Wayland, Mo	14	25	26	16.94	26
Salt: New London, Mo. (near)	19	27	29	22.7	28
Mississippi:					
Hannibal, Mo	13	27	28	13.72	27
Louisiana, Mo	12	27	29	13.8	28
Missouri Basin					
Grand:					
Gallatin, Mo	20	25	27	23.07	25
Chillicothe, Mo	18	25	28	25.61	27
Ohio Basin					
Allegheny:					
Warren, Pa	12	27	27	12.5	27
Parkers Landing, Pa	20	27	27	25.8	27
Lock No. 8, Mosgrove, Pa	24	28	28	34.0	28
Lock No. 5, Schenley, Pa	24	28	28	31.7	28
Lock No. 4, Natrona, Pa	24	28	28	28.7	28
Lock No. 3, Springdale, Pa	25	28	28	28.7	28

Table of flood stages during February 1936—Continued

[All dates in February unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
MISSISSIPPI SYSTEM—continued					
Ohio Basin—Continued					
	Feet			*Feet*	
Youghiogheny: West Newton, Pa	20	26	26	23.0	26
Walhonding: Walhonding, Ohio	8	25	28	14.2	27
Tuscarawas:					
Newcomerstown, Ohio	16	28	(1)	17.45	28
Coshocton, Ohio	11	26	(1)	17.8	28
Muskingum: Lock No. 7, McConnellsville, Ohio	22	27	29	24.1	27
Little Kanawha:					
Glenville, W. Va	23	14	15	24.0	15
Creston, W. Va	20	15	15	23.9	15
Olentangy: Delaware, Ohio	9	26	27	10.5	27
Scioto:					
LaRue, Ohio	11	25	28	13.55	27
Prospect, Ohio	10	26	29	12.57	27
Circleville, Ohio	14	26	29	18.62	28
Chillicothe, Ohio	16	27	29	20.1	28
West Fork of White:					
Anderson, Ind	8	15	16	8.4	16
		25	Mar. 1	11.4	27
Indianapolis, Ind	12	27	27	12.6	27
Elliston, Ind	18	27	Mar. 3	23.9	Mar. 1
Edwardsport, Ind	12	27	Mar. 5	18.7	Mar. 2
East Fork of White: Seymour, Ind	10	15	17	12.4	15, 16
		28	29	10.3	28
White:					
Petersburg, Ind	16	Mar. 2	Mar. 6	18.6	Mar. 4
Hazelton, Ind	16	Mar. 2	Mar. 7	19.3	Mar. 5
Wabash:					
Bluffton, Ind	10	26	Mar. 1	12.9	26
Logansport, Ind	17	27	27	17.8	27
Lafayette, Ind	11	25	Mar. 4	25.5	27
Covington, Ind	16	26	Mar. 5	28.8	29
Terre Haute, Ind	14	26	Mar. 8	23.7	Mar. 1
Vincennes, Ind	14	Mar. 3	Mar. 11	21.3	Mar. 5
Mount Carmel, Ill	19	Mar. 4	Mar. 9	21.9	Mar. 7
New Harmony, Ind	15	Mar. 6	Mar. 11	16.8	Mar. 8
Pigeon: Newport, Tenn	6	4	4	10.8	4
French Broad:					
Oldtown, Tenn	6	4	5	9.2	4
Dandridge, Tenn	12	4	5	12.8	5
Asheville, N. C	6	4	4	6.4	4
Little Tennessee: McGhee, Tenn	18	5	5	21.5	5
Hiwassee: Charleston, Tenn	22	5	5	27.0	5
Tennessee:					
Chattanooga, Tenn	30	6	7	31.3	6
Bridgeport, Ala	18	6	8	21.6	7
Widows Bar Lock, Ala.:					
Upper gage	17	5	9	27.6	7
Lower gage	26	6	9	30.3	7
Guntersville, Ala	25	5	10	28.9	8
Florence, Ala	18	----------	----------	17.9	9
Riverton Lock, Ala	33	6	12	36.5	10
Savannah, Tenn	39	----------	----------	35.2	10, 11
Ohio:					
Pittsburgh, Pa	25	27	28	29.2	28
Dam No. 6, Beaver, Pa	30	27	28	33.9	28
Dam No. 46, Owensboro, Ky	41	22	24	41.9	23
Dam No. 47, Newburgh, Ind	38	19	25	46.1	23
Evansville, Ind	35	19	25	40.6	24
Dam No. 48, Cypress, Ind	38	23	25	45.1	24
Dam No. 50, Fords Ferry, Ky	34	25	26	35.6	25
PACIFIC SLOPE DRAINAGE					
San Joaquin Basin					
Kings: Piedra, Calif	10	2	2	10.35	2
		22	22	12.40	22
		14	15	12.2	15
Mokelumne: Bensons Ferry, Calif	12	18	18	12.5	18
		23	25	14.3	24
Sacramento Basin					
Sacramento:					
Red Bluff, Calif	23	21	22	25.4	22
Knights Landing, Calif	30	22	27	31.0	25

[1] Continued into March.